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| EXAMINER | |
|---|---|
| WOZNIAK, JAMES S | |
| ART UNIT | PAPER NUMBER |
| 2655 | 2 |

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Please find below and/or attached an Office communication concerning this application or proceeding.

| *Office Action Summary* | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/928,766 | ARONOWITZ, HAGAI | |
| | Examiner | Art Unit | |
| | James S. Wozniak | 2655 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *08/13/2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22 and 27-30* is/are rejected.

7)☒ Claim(s) *23-26* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 August 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

## Detailed Action

### *Drawings*

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Fig. 2, Element 86, and Fig. 3, Element 125.

A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application.

The objection to the drawings will not be held in abeyance.

### *Claim Objections*

2. **Claims 10 and 20** are objected to because of the following informalities:

- With respect to **Claim 10**, "the method of claim 7" should be corrected to read --the method of claim 9-- because, if dependent upon claim 7, the claim would lack antecedent basis for "the absolute scores".
- With respect to **Claim 20**, "the article of claim 17" should be corrected to read --the article of claim 19-- because, if dependent upon claim 17, the claim would lack antecedent basis for "the absolute scores".

The examiner has interpreted "claim 7" to mean Claim 9 and "claim 17 to mean Claim 19 for the application of prior art

Appropriate correction is required.

## *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 1-8, 11-18, 27, and 28** are rejected under 35 U.S.C. 102(b) as being anticipated by Yamaguchi et al *(U.S. Patent: 6,026,359)*.

With respect to **Claim 1**, Yamaguchi discloses:

A method comprising:

Determining signal attributes and noise attributes of at least two signal portions including speech *(speech models and noise data extracted from speech and noise portions of input speech, Col. 11, Lines 38-41)*; and

Deriving a distance measure for one signal portion by using the signal attributes of both signal portions *(obtaining a difference in noise levels between input and training noisy speech through a difference calculation utilizing noisy speech HMMs containing speech and noise data from speech and noise portions of a speech input, Col. 11, Lines 42-45, and Fig. 3, Element 9).*

With respect to **Claim 2**, Yamaguchi recites:

Deriving the distance measure, including deriving a relative noise measure between the at least two signal portions by distributing the signal attributes over the at least two signal portions *(noise levels represented by a background noise data distributions, used to calculate a difference between input and training speech noise for further adaptation of a noisy speech HMM for recognition, Col. 10, Lines 47-54).*

With respect to **Claim 3**, Yamaguchi discloses:

The speech model adaptation method including:

Receiving training speech data including noise components and the at least two signal portions *(input noisy speech containing speech and noise portions, and initial noise HMMs, Col. 11, Lines 38-45)*;

Combining the signal attributes of the at least two signal portions into a signal content and combining the signal and noise attributes of the at least two signal portions into a signal and noise content *(noise extraction unit, Fig. 3, Element 2, for extracting both noisy speech and noise present in speech and noise portions of input speech that, in combination, fully describe the input speech in the form of a HMM, Col. 11, Lines 38-45)*;

Calculating a compensation ratio of the signal and noise content to the signal content in order to derive the relative noise measure *(mismatch between noise levels in training and input speech determined using a difference calculation, further utilized in updating a HMM for recognition, Col. 11, Lines 42-50)*; and

Adjusting a mismatch indicative of a noise differential between the noise components present in the training speech data and the noise attributes present in the at least two signal

portions based on the relative noise measure *(updating a HMM based upon a difference between training and input speech containing both noise and speech portions, Col. 11, lines 45-52).*

With respect to **Claim 4**, Yamaguchi recites:

The speech model adaptation method, including deriving from a training template, a signal profile based on a model trained on the training speech data to determine the mismatch between the noise components and the noise attributes *(initial (training) HMM used in a difference calculation with an input speech HMM containing noise data to determine a mismatch, Col. 11, Lines 42-45).*

With respect to **Claim 5**, Yamaguchi discloses:

The speech model adaptation method, including compensating the model in response to the relative noise measure while applying a parallel model combination mechanism *(updating a noisy speech HMM, Fig. 3, Element 10, in response to a noise level difference between input and training speech, Element 9. The noisy speech HMM is comprised of a combination of a clean speech HMM and a noise HMM, Element 5, a combination that is well known in the art as parallel model combination, Col. 1, Lines 53-55).*

With respect to **Claim 6**, Yamaguchi discloses:

A speech model adaptation method comprising:

Extracting from a noisy speech signal an utterance, said noisy speech signal including a first portion with first signal-and-noise attributes and a second portion with second signal-and-noise attributes, wherein said utterance extracted from the noisy speech signal based on a first model trained on training speech data *(extracted noisy speech containing speech and noise*

*portions represented by a noisy speech HMM, Col. 11, Lines 38-45, wherein the speech portion corresponds to a clean speech HMM stored in a memory, Fig. 3, Element 4)*;

Selectively combining across the noisy speech signal the first and second signal-and-noise attributes of both the first and second portions to derive a compensation term for the first model (combined speech and noise represented by a noisy speech HMM *(adaptation target noise HMM) used in a difference calculation with a training HMM (initial HMM) to determine the amount of compensation necessary to overcome a noise level mismatch, Col. 11, Lines 38-52)*;

Deriving a second model by compensating the first model based on the compensation term *(updating an initial noisy speech HMM based on the result of a difference calculation, Col. 11, Lines 45-52)*; and

Correcting a mismatch indicative of a noise differential between the first portion and the second portion based on the second model *(updating an initial noisy speech HMM in order to correct a mismatch in noise levels (difference between noise and speech portions) between a speech input and a training HMM, Col. 11, Lines 45-56).*

With respect to **Claim 7**, Yamaguchi recites:

A speech model adaptation method, including using a parallel model combination mechanism to determine said mismatch as a function of the compensation term, said first model based on a plurality of recognition models including at least one speech model and at least one noise model *(updating (compensating) a noisy speech HMM, Fig. 3, Element 10, in response to a noise level difference between input and training speech, Element 9, and Col. 11, Lines 45-52. The noisy speech HMM is comprised of a combination of a clean speech HMM and a noise*

*HMM, Element 5, a combination that is well known in the art as parallel model combination, Col. 1, Lines 53-55).*

With respect to **Claim 8**, Yamaguchi discloses:

A speech model adaptation method, including training the at least one speech model and the at least one noise model with the training speech data *(speech and noise models comprised of training data, Col. 5, Lines 21-27).*

**Claim 11** contains subject matter similar to Claim 1, and thus, is rejected for similar reasons.

Yamaguchi further discloses model adaptation system and method use with a computer readable medium *(Col. 16, Line 58- Col. 17, Line 6).*

**Claim 12** contains subject matter similar to Claim 2, and thus, is rejected for similar reasons.

**Claim 13** contains subject matter similar to Claim 3, and thus, is rejected for similar reasons.

**Claim 14** contains subject matter similar to Claim 4, and thus, is rejected for similar reasons.

**Claim 15** contains subject matter similar to Claim 5, and thus, is rejected for similar reasons.

**Claim 16** contains subject matter similar to Claim 6, and thus, is rejected for similar reasons.

Yamaguchi further discloses model adaptation system and method use with a computer readable medium *(Col. 16, Line 58- Col. 17, Line 6).*

**Claim 17** contains subject matter similar to Claim 7, and thus, is rejected for similar reasons.

**Claim 18** contains subject matter similar to Claim 8, and thus, is rejected for similar reasons.

**Claim 27** contains subject matter similar to Claim 1, and thus, is rejected for similar reasons.

**Claim 28** contains subject matter similar to Claims 2, 4, and 5, and thus, is rejected for similar reasons.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 9, 10, 19, 20, 22, 29, and 30** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi et al.

With respect to **Claim 9**, Yamaguchi teaches the speech model adaptation method featuring means to determine and compensate for a mismatch between noise levels of a speech input and training HMM. Yamaguchi does not specifically suggest generating absolute scores for speech and noise attributes of a noisy speech signal, however, the examiner takes official notice that it is well known in the art to calculate the absolute value (actual amount of difference

between noise and speech, whether speech exceeds noise or vice versa) of speech and noise attributes in order to determine an absolute difference amount between speech and noise for comparison to a training HMM, to determine a compensation amount to account for the noise level difference between a training HMM and input speech. Thus, in order to determine an absolute amount of noise differential to be compared with an initial noise model to further calculate a mismatch compensation, it would have been obvious to one of ordinary skill in the art at the time of invention to calculate absolute scores to describe speech and noise portions of a speech signal.

With respect to **Claim 10**, Yamaguchi further recites:

A speech model adaptation method of Claim [9], wherein combining further includes:

Normalizing the absolute scores to generate normalized absolute scores for the first and second signal-and-noise attributes of both the first and second portions of the noisy speech signal (*calculating the average spectrum SNR to determine an error amount (compensation), Col. 12, Lines 32-46)*; and

Calculating the compensation term from the normalized absolute scores (*calculating the average spectrum SNR to determine an error amount (compensation), Col. 12, Lines 32-46).*

It would have been obvious to one of ordinary skill in the art, at the time of invention, that an SNR, a well-known factor in the calculation of noise compensation, of input speech would function as the normalized value since it represents signal level with respect to the noise level of a noisy speech signal.

**Claim 19** contains subject matter similar to Claim 9, and thus, is rejected for similar reasons.

**Claim 20** contains subject matter similar to Claim 10, and thus, is rejected for similar reasons.

With respect to **Claim 22**, Yamaguchi discloses:

Using a training template including a plurality of frames each frame including one or more channels each channel including first segments with lower signal-to-noise portions and second segments with higher signal-to-noise portions; and compensate the model for the mismatch in the utterance and the training template based on the compensation term by counting over all the frames of the plurality of frames both the first segments with lower signal-to-noise portions and the second segments with higher signal-to-noise portions in the utterance of the noisy speech signal *(calculating the average spectrum SNR to determine an error amount (compensation), Col. 12, Lines 32-46).*

It would have been obvious to one of ordinary skill in the art, at the time of invention, that the calculation of an average spectrum SNR would function as counting the number of frames with lower and higher SNRs since both determine the overall difference between training HMMs and input speech.

With respect to **Claims 29 and 30**, Yamaguchi teaches the model adaptation apparatus utilizing a storage medium as applied to Claim 11. Yamaguchi does not specifically disclose apparatus implementation in a wireless transceiver communicating over an open air interface; however, the examiner takes official notice that it is well known in the art to use noise model adaptation in a transceiver (mobile telephone operating in an open air interface), due to the presence of variable noise levels in such an environment, in order to improve recognition accuracy at a remote location. Thus, in order to improve recognition accuracy, it would have

been obvious to one of ordinary skill in the art at the time of invention, to implement the noise model adaptation apparatus as taught by Yamaguchi and applied to Claim 11 in such a wireless application.

7. **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi in view of Kanevsky et al *(U.S. Patent: 5,897,616)*.

With respect to **Claim 21**, Yamaguchi teaches the noise model adaptation device as applied to Claim 20. Yamaguchi does not teach model adaptation for use in a speaker verification and recognition application, however Kanevsky discloses:

The model adaptation device, further storing instructions that enable the processor-based system to:

Compare the normalized absolute scores with a threshold associated with a speech profile to verify a speaker of the utterance against the speech profile *(compare a speaker score to a threshold to implement speaker verification, Abstract)*; and

Compare the normalized absolute scores with a database including a plurality of speech profiles associated with one or more registered speakers to identify the speaker of the utterance against the database *(identification of a speaker through information contained in a user database, Abstract, and Fig. 2, Element 18)*.

Yamaguchi and Kanevsky are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the means of speaker verification and recognition through threshold comparison with user data contained in a database as taught by Kanevsky with

the noise model adaptation device as taught by Yamaguchi in order to increase the speaker recognition accuracy in a variable noisy environment that causes lower recognition accuracy *(Yamaguchi, Col. 1, Lines 48-52)*. Therefore, it would have been obvious to combine Kanevsky with Yamaguchi for the benefit of obtaining higher recognition accuracy in a noisy speech environment through model adaptation, to obtain the invention as specified in Claim 21.

### *Allowable Subject Matter*

8. **Claims 23-26** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and the intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter: the prior art does not teach:

- With respect to **Claim 23**, a noise model mismatch compensation, in a device utilizing parallel model combination, derived from the ratio of the number of frames containing a high SNR and a low SNR over all of the frames.
- **Claims 24-26** contain allowable subject matter because they further limit their parent claims.

## *Conclusion*

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Komori et al *(U.S. Patent: 5,956,679)*- discloses a speech processing device utilizing PMC for further speech recognition.
- Rahim *(U.S. Patent: 5,960,397)*- teaches a noise model adaptation method implemented in a speech recognition system in a wireless environment.
- Chiang *(U.S. Patent: 6,188,982)*- teaches a noise compensation device utilizing parallel model combination that compensates noise models through interpolation.
- Hirsch *("Adaptation of HMMs in the Presence of Additive and Convolutional Noise," 1997)*- discloses a PMC technique for noise model adaptation of HMMs.
- Gales et al *("Robust Continuous Speech Recognition Using Parallel Model Combination," 1996)*-discloses a PMC technique for noise model adaptation utilizing a mismatch calculation to determine a compensation amount.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to James S. Wozniak whose telephone number is (703) 305-8669 and email is James.Wozniak@uspto.gov. The examiner can normally be reached on Mondays-Fridays, 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Talivaldis Ivars Smits can be reached at (703) 306-3011. The fax/phone number for the Technology Center 2600 where this application is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the technology center receptionist whose telephone number is (703) 306-0377.

James S. Wozniak
4/29/04

Tālivaldis Ivars Šmits

TĀLIVALDIS IVARS ŠMITS
PRIMARY EXAMINER